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SCOPING REVIEW

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Hospital-acquired pressure injury prevention in people with a BMI of 30.0 or higher: A scoping review

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Abstract

Aim(s): To: (1) explore current best practices for hospital-acquired pressure injury prevention in high BMI patients; (2) summarize nurses' experiences in preventing and managing them; (3) explore the association between a high BMI and occurrence and severity of pressure injury.

Design: Exploratory.

Methods: Scoping review.

Data Sources: Ovid MEDLINE, EBSCO CINAHL Plus, JBI Evidence Synthesis, Scopus, Embase, clinical registries and grey literature (search dates: January 2009 to May 2021).

Results: Overall, 1479 studies were screened. The included studies were published between 2010 and 2022. Five interventional studies and 32 best practice recommendations (Objective 1) reported low-quality evidence. Findings of thematic analysis reported in nine studies (Objective 2) identified nurses' issues as insufficient bariatric equipment, inadequate staffing, weight bias, fatigue, obese-related terminology issues, ethical dilemmas and insufficient staff education in high BMI patients' pressure injury prevention. No association between hospital-acquired pressure injury occurrence and high BMI were reported by 18 out of 28 included studies (Objective 3).

Conclusion: Quality of evidence was low for the interventional studies and best practice recommendations.

Implications for the Profession and/or Patient Care: Current (2019) International Pressure Injury Guideline to be used despite the low quality of evidence of most best practice recommendations.

Impact Statement: This study addressed hospital-acquired pressure injury prevention in high BMI patients. Greater proportion of studies in this review found no association between high BMI and occurrence of hospital-acquired pressure injury. Nurses need educational interventions on pressure injury prevention in high body mass index people, sufficient staffing for repositioning and improved availability of bariatric equipment.

Reporting Method: We adhered to relevant EQUATOR guidelines, PRISMA extension for scoping reviews.

Patient or Public Contribution: No patient or public contribution.

What Does this Paper Contribute to the Wider Global Clinical Community?Larger clinical trials are needed on repositioning frequency, support surfaces, prophylactic dressings and risk assessment tools to inform clinical practice guidelines on pressure injury prevention in high BMI people.

Protocol Registration: Wound Practice and Research (https://doi.org/10.33235/wpr.29.3.133-139).

KEYWORDS

adult nursing, clinical guidelines, hospital care, patient safety, pressure injury, pressure ulcers, quality of care, systematic reviews and meta-analyses, tissue viability, wound care

1 | INTRODUCTION

A pressure injury is defined as 'localised damage to the skin and/or underlying tissue, as a result of pressure or pressure in combination with shear' (European Pressure Ulcer Advisory Panel [EPUAP], 2019, p. 16). Hospital-acquired pressure injuries are a common complication (Labeau et al., 2021). They develop during hospitalization and relate to worse health outcomes, reduced quality of life and significant healthcare costs (Kayser et al., 2019). Most of them are preventable through interventions by healthcare workers, carers and patients (Barakat-Johnson et al., 2019).

Skin changes are common in high body mass index (BMI) patients. Body mass index is a weight screening method calculated by dividing weight in kilograms by the square of height in meters. BMI categories developed by the World Health Organization and National Heart, Lung and Blood Institute consider a BMI over 30.0 obese (Zierle-Ghosh & Jan, 2020). The World Health Organization (WHO) classification is present; however, its utilization varies across different countries, with the presence of alternative indices that exhibit minor discrepancies from the WHO classification, thereby posing challenges in drawing conclusive findings (Misra, 2015; WHO, 2010). In this review, 'high BMI' refers to a BMI of 30.0 or higher.

Excess weight may change the lymphatic system, collagen function and micro and macro circulation. Excessive sweating, common in high BMI people, can cause maceration and microorganism growth between skin folds (Earlam & Woods, 2020). Heavy adipose tissue increases the risk of friction and shear, skin tears, maceration and pressure injury (Hirt et al., 2019), while poor flexion, mobility and underlying health conditions encourage pressure injury development in acute care settings (Baronoski, 2018).

Limited studies investigating the association between high BMI and pressure injury in acute care settings reported contrasting findings. Three studies found the incidence of pressure injury is highest in low and high BMI patients (Kayser et al., 2019; Ness et al., 2018; Peixoto et al., 2019), while others indicate body fat may protect against pressure injuries (Großschädl & Bauer, 2022). Coyer et al. (2022) found increased weight influences pressure injuries caused by therapeutic devices, while minimal information was provided on their severity in high BMI patients.

Current best practices to prevent pressure injury in high BMI patients involve a multifactorial approach, including risk assessment, nutritional management, providing redistribution support surfaces, appropriate equipment, prophylactic dressings, repositioning and skin care (Alderden et al., 2020; Berrios, 2016; European Pressure Ulcer Advisory Panel et al., 2019; Lloyd-Jones, 2021). The WHO classifies obesity based on BMI categories into the following three classes, starting at a BMI of 30.0: (1) obesity class I (30.0–34.9), (2) obesity class II (35.0–39.9) and (3) obesity class III (above 40) (WHO, 2010). The evidence that the commonly used risk assessment tools accurately predict risk or reduce pressure injury occurrence is limited (Latimer, 2016; Moore & Patton, 2019). Moreover, no single tool that reflects all relevant risk factors has been validated for use in the high BMI population (Beitz, 2014). Nurses' issues regarding caring for high BMI patients and hospital-acquired pressure injury include equipment availability, adequate staffing levels, increased documentation and both nurse and patient education (Chaboyer et al., 2017; Lloyd-Jones, 2021). A common theme identified was increased nurse effort to care for high BMI patients with absent appropriate equipment (Harris & Castle, 2019).

1.1 | Rationale

The latest international pressure injury prevention and management guidelines state that there is limited research concerning the high BMI population (European Pressure Ulcer Advisory Panel et al., 2019). Pressure injury is a quality-of-care indicator, and its prevention is a priority in healthcare. High BMI patients have longer hospital stays, increased likelihood of ICU admission and a greater risk of readmission within 28 days of discharge (Fusco et al., 2017). A single hospital-acquired pressure injury case can incur an average cost of $22,466 per case in Australia (Ness et al., 2018) with treatment costing 2.5

times more than prevention. However, multiple studies identified nurses' insufficient knowledge on pressure injury prevention (Dalvand et al., 2018; De Meyer et al., 2019; Fulbrook et al., 2019; Halasz et al., 2021; Tirgani et al., 2018; Walker et al., 2019), yet they have a responsibility to provide evidence-based quality care to prevent hospital-acquired pressure injury (Tirgani et al., 2018).

Research is needed to clarify occurrence, severity and best practices for hospital-acquired pressure injury prevention in high BMI patients, and discover nurses' experiences with this group. Preventing pressure injuries can reduce healthcare costs and negative impacts on patients, families and healthcare workers. This scoping review addresses issues regarding quality, safety, cost and nurses' experiences relating to pressure injury prevention in high BMI patients. This scoping review is part of a larger collaborative capacity-building project across Monash Partners healthcare services (Team et al., 2021).

1.2 | Objectives

The objectives of this scoping review are: (1) to explore current research examining best practices for hospital-acquired pressure injury prevention in high BMI patients; (2) to summarize nurses' experiences in preventing and/or managing hospital-acquired pressure injury in high BMI patients; and (3) to check the association between high BMI and occurrence and severity of hospital-acquired pressure injury.

2 | METHODS

2.1 | Protocol and registration

The review was guided by the six framework stages originally developed by Arksey and O'Malley (2005) and further enhanced by Levac et al. (2010). The final protocol of this scoping review was deposited in the Open Science Framework (Marshall et al., 2021).

2.2 | Inclusion and exclusion criteria

Inclusion and exclusion criteria are presented in Table 1.

2.3 | Information sources

Electronic bibliographic databases searched from March to May 2021 include Ovid MEDLINE, EBSCO CINAHL Plus, JBI Evidence

TABLE 1 Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Publication time	Given the National Pressure Ulcer Advisory Panel and the European Pressure Ulcer Advisory Panel international clinical practice guidelines for pressure injury prevention and treatment were published in 2009, we included studies published from January 2009 to September 2022.	Studies published before January 2009 were excluded.
Language	Studies published only in the English language have been considered as the practical use of a translator was challenging to incorporate in the timeframe proposed.	Studies published in languages other than English.
Full-text availability	Available full text.	Full text is not available.
Participants	• Patients aged 18 and over with a BMI of 30 or higher. • Nurses in acute care settings.	• Patients under 18 years of age. • Nurses in other settings—not acute care.
Concept	• Main concept—hospital-acquired pressure injury	• Community-acquired pressure injury • Other concepts, including moisture dermatitis and skin tears
Context	• Acute care settings have been chosen, including ICU and operative areas. • ICUs are included due to the burden of pressure injury in ICU worldwide (Labeau et al., 2021).	• Community care • Home care • Long-term care • Primary care • Rehabilitation facilities
Study types	• Quantitative and qualitative research have been sourced. • All studies were considered regardless of design.	Not applicable, since all studies were considered regardless of design.
Outcomes	• Best preventative practices currently used for high BMI patients in acute care settings, including risk assessment tools, clinical judgement, support surfaces, dressings, equipment, repositioning and nutrition. • Nurses' knowledge of best practices and their experiences with hospital-acquired pressure injury prevention in high BMI patients in acute care settings, including the availability of equipment, staffing and safety issues relating to repositioning. • Occurrence and severity of pressure injury in high BMI individuals in acute care.	

Synthesis, Scopus and Embase. Clinical trial registries were searched as was grey literature through Google Scholar and Open Grey. An additional search was undertaken in September 2022 of these same databases (Table 2).

2.4 | Search

We used the Joanna Briggs Institute search strategy recommendations (Joanna Briggs Institute, 2020). Searching with Medical Subject Headings (MeSH) was used to increase precision and efficiency. Excerpta Medica Thesaurus (Emtree terms) was used in Embase, this contains highly specific terms and produces considerable coverage and recall (Bramer et al., 2018) which was an important factor for choosing this database. Boolean operator 'OR' was used to group synonyms and 'AND' to group components together. Truncation/wildcard symbols and phrases requiring double quotes will be tailored to each database. The asterisk '*' was used at the end of words to retrieve suffix variations for all databases.

Each search was checked for errors, such as missing Boolean operator 'OR' which could have reduced search results. Clues for errors were checked for in the number of search results, being higher or lower than expected (Bramer et al., 2018).

2.5 | Selection of sources of evidence

A two-stage process was used to screen and select studies.

Stage 1: Initial screening checked titles and abstracts of retrieved articles against the predetermined inclusion and exclusion criteria. Studies meeting inclusion criteria were stored in an EndNote library.

Stage 2: Full texts of potential studies were sourced, and eligibility was assessed using the inclusion criteria. The studies were assessed by two independent reviewers, a third reviewer's opinion was called for where disagreement and uncertainty occurred.

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2009 Flow Diagram (Data S1) was used to outline the retrieved, assessed, excluded and included study numbers.

2.6 | Data charting process

Covidence was utilized to chart the data. Each included study was assessed using the data extraction template (Data S3, Supplementary material II). Two independent reviewers extracted data from 10% of included studies to ensure consistency.

2.7 | Data items

We extracted study characteristics, including the study type, year, sample size, location, acute care area, patient weight characteristics and statistical results. Quotes of nurses' experiences and descriptions of themes which emerged are charted. Severity of pressure injury developed was not presented in a table due to the low number of relevant studies and variability in reporting. Recommendations for pressure injury prevention relating to high BMI patients have been adapted from the *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline 2019* along with the strength of evidence rating.

2.8 | Critical appraisal of individual sources of evidence

The included studies were examined to assess credibility, value and relevance to clinical practice. The quality and validity of included

TABLE 2 Ovid MEDLINE search strategy.

Concept		
MeSH: Exp pressure ulcer/	OR	Truncated keywords and synonyms: Bedsore* or bed sore* or pressure ulcer* or pressure injur* or decubitus or hospital-acquired pressure injury or HAPU or pressure sore*
AND		
MeSH: exp body mass index/or exp overweight/	OR	Truncated keywords and synonyms: BMI or obes* or bariatric or body mass index or overweight
AND		
MeSH: Critical care/or hospitalization/or exp hospitals/or exp hospital units/	OR	Truncated keywords and synonyms: acute care* or hospital* or intensive care* or critical care* or ward* or unit*

Note: This search was undertaken on 17 May 2021 and retrieved 175 results. An additional search was undertaken on 16 September 2022 and retrieved 36 additional results.

studies were assessed using the Critical Appraisal Skills Programmes (CASP) Checklist (Data S3, Supplementary material III). Differing from the protocol, we used the Joanna Briggs Institutes Critical Appraisal Tool Checklist for Analytical Cross-Sectional studies because there is no CASP checklist specifically designed for cross-sectional studies. One reviewer (VM) independently performed quality appraisal on all included studies, if doubts were raised, a second reviewer (VT) was consulted for discussion.

2.9 | Synthesis of results

These scoping review findings are reported in a rigorous manner in the three steps below (Levac et al., 2010):

Step 1: Analysing the data involved a numerical summary and thematic analysis. Characteristics of included studies are presented in Table 4, Data S3, supplementary materials IV–VIII.

Step 2: Depending on findings, results are presented through themes and strengths and gaps identified. The data were summarized using tables and a flow diagram, and a descriptive format used for qualitative studies was included. Commonalities identified between studies have been synthesized and presented.

Step 3: Results aim to describe clinical practices specific to the prevention of hospital-acquired pressure injury in the high BMI population; high BMI influence on incidence and severity of pressure injury, and nurses' experiences of hospital-acquired pressure injury prevention in high BMI patients. We have anticipated and identified research gaps in these areas, given the low search results initially retrieved.

3 | RESULTS

3.1 | Selection of sources of evidence

Forty-two studies were included in the review after eliminating duplicates and studies not meeting inclusion (Figure 1). All included studies were retrieved from large bibliographic databases. We were unable to find any relevant studies from clinical registries or grey literature.

3.2 | Characteristics of sources of evidence

The included studies were published between 2010 and 2022. Five interventional studies were related to Objective 1 (Atrous et al., 2021; Ghezeljeh et al., 2017; Powers, 2016; Rose et al., 2022; Sutton et al., 2013). Five case studies (Dambaugh & Ecklund, 2016; Spike, 2018; Tammellero, 2011; Tatusov et al., 2017; Temple et al., 2017), two qualitative studies (Barakat-Johnson et al., 2019; Hales et al., 2018) and two mixed methods studies (Tanneberger & Ciupitu-Plath, 2018; Walker et al., 2019) were related to Objective 2 and 28 quantitative studies— to Objective 3 (Amini et al., 2022; Buffon et al., 2022; Capasso et al., 2022; Carson et al., 2018;

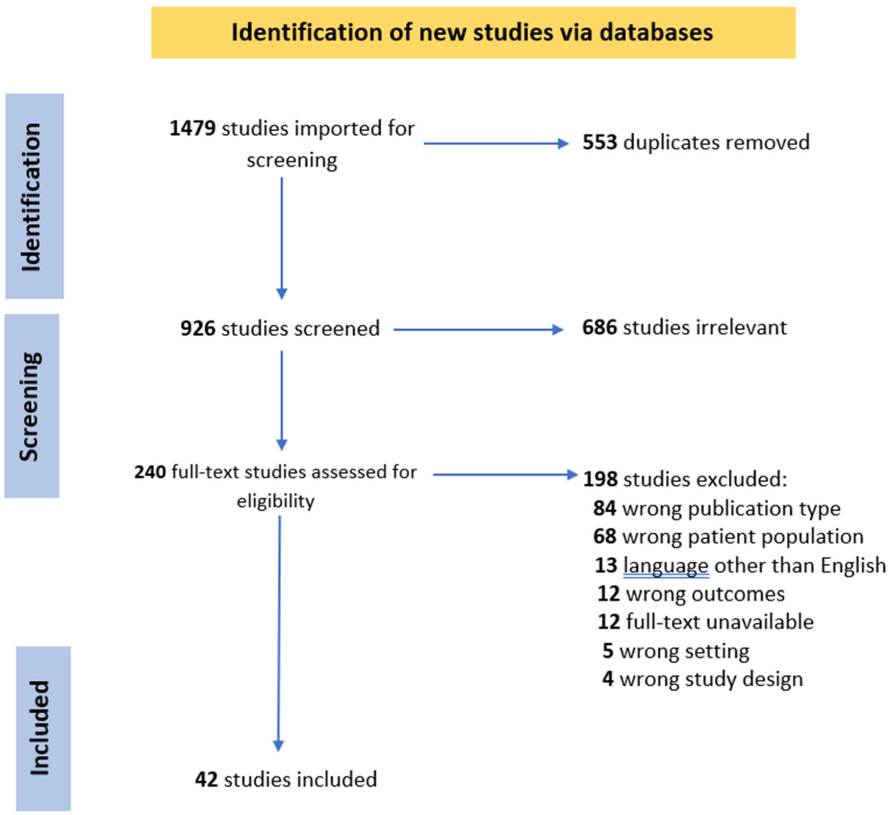

FIGURE 1 PRISMA flow diagram.

Coyer et al., 2014; Ditillo et al., 2014; Drake et al., 2010; Gardiner et al., 2014; Grap et al., 2019; Großschädl & Bauer, 2022; Hobson et al., 2017; Hyun et al., 2014; Kayser et al., 2019; Kottner et al., 2011; Litcherfeld-Kottner et al., 2020; Mananzo et al., 2014; Miller et al., 2016; Ness et al., 2018; O'Brien et al., 2014; Pokorny et al., 2014; Qaddumi & Almahmoud, 2019; Raff et al., 2016; Swanson et al., 2011; Tracy et al., 2020; VanGilder et al., 2010, 2021; Verekova et al., 2020; Workum et al., 2022).

3.3 | Critical appraisal within sources of evidence

Data S3, Supplementary materials IX to XIII provides a critical appraisal summary of all included studies. Interventional studies related to Objective 1 obtained a score out of 36, with only one considered to be high quality which was a randomized controlled trial (RCT). The case studies did not provide as high-level value as the other qualitative studies did. Four cohort studies used a single-centre design impacting the external validity of their findings. Case–control studies were of reliable quality and two cross-sectional studies had unclear inclusion criteria, while another omitted confounding factors.

The best practice recommendations we adapted from *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline 2019* has only one high-quality recommendation, the majority based on low-quality evidence.

3.4 | Results of individual sources of evidence

Tables 3 and 4, andData S3, Supplementary materials IV–VIII outline the characteristics of all included studies and are grouped into objectives 1–3. The relevant data have been charted according to the specific objective.

3.5 | Synthesis of results

3.5.1 | Objective 1. Best practices for hospital-acquired pressure injury prevention in people with a BMI of 30 or higher

Best practice guidelines

Pressure injury prevention guidelines were searched from different countries, however, all appeared to be based on the International clinical practice guidelines (European Pressure Ulcer Advisory Panel et al., 2019). The latest Guidelines (2019) were searched for recommendations applicable to high BMI patients (Table 3). The main clinical practice areas covered are risk assessment, skin assessment and care, protective dressings, nutrition, equipment, support surfaces, repositioning, mobilization, interdisciplinary approach, patient education and health professional education.

Non-interventional studies. Risk assessment. Raff et al. (2016) mention that numerous studies evaluated the effectiveness of the Braden (Braden & Bergstrom, 1987), Norton (Norton et al., 1962), Waterlow Risk Assessment Pressure Score (Waterlow, 1985) and Cubbin-Jackson scales (Cubbin & Jackson, 1991) at predicting pressure injury development; however, no clear consensus identifies the most reliable or effective in the general population (Raff et al., 2016), including high BMI people. Coyer et al. (2014) found the Braden scale unrelated to medical device pressure injury development. Hyun et al. (2014) found BMI did not increase the accuracy of the Braden scale for predicting pressure injuries (Hyun et al., 2014). Amini et al. (2022) found no relationship between high BMI patients with a Braden scale score < 14 and pressure injury development. Drake et al. (2010) could not determine subscale factors influencing the Braden scare scores in the sample. Therefore, high BMI in relation to one or more of the subscales, such as mobility or moisture, was undetermined. Miller et al. (2016) identified the Braden scale as a valid predictor of pressure injury development. A five-point increase on the Braden scale, which represents a decreased risk of pressure injury, was associated with a 34% risk of hospital-acquired pressure injury. Cumulative Braden scale score on admission predicted hospital-acquired pressure injury occurrence during hospital stay (p-value = .02).

Ness et al. (2018) mention the Waterlow Risk Assessment Tool (Waterlow, 1985) is the only one considering the effects of weight or BMI. This tool rates BMI in terms of risk levels from 0 to 3, with the underweight group having the highest score. The obese group is associated with a score of 2 but does not differentiate classes of obesity. A 2009 study showing Braden scale scores indicate pressure injury risk at two ends of the weight spectrum, is supported by Pokorny et al. (2014). In patients with a BMI ≥ 30, high-risk friction/shear, nutrition and mobility were associated with pressure injury more than those with a BMI ≤30 and were related to pressure injury occurrences on measures except for moisture. Swanson et al.'s (2011) cross-sectional study found patients with a BMI ≥ 30 who had high-risk mobility and friction/shear subscale scores had a higher prevalence of pressure injury than those with a BMI ≤30. Grap et al. (2019) found patients with a high BMI and low Braden (Braden & Bergstrom, 1987) scores had an increased risk for pressure injury when combined with operating theatre bedtime in a multivariable model.

Nutrition. Ness et al. (2018) found significant relationships between obesity, malnutrition and pressure injury in hospital inpatients. The risk of malnutrition morbidly obese patients developing PI was found to be 11 times higher than that of well-nourished morbidly obese patients (Ness et al., 2018). Dambaugh and Ecklund (2016) discuss how high BMI patients are often deficient in essential nutrients due to high-calorie malnutrition, which increases the risk of pressure in injury. Nurses were suggested to use evidence-based clinical guidelines to manage the complex nutrition needs of patients with high BMI (Dambaugh & Ecklund, 2016).

Skin assessment and care. Coyer et al. (2014) examined the prevalence, severity and location of medical device-related pressure

TABLE 3 Research Question 1. Summary of the best practice recommendations for hospital-acquired pressure injury prevention in people with a BMI of 30 or higher adapted from the EPUAP, NPIAP and PPPIA Clinical Practice Guidelines 2019.

Topic	Recommendation	Strength of evidence
Risk assessment	• Assess patients as soon as possible after admission • Identify risk factors for pressure injury which includes obesity • Use a risk assessment tool when undertaking pressure injury risk assessment. • Use clinical judgement when interpreting the assessment findings. • There is no risk assessment tool specifically recommended for high BMI patients.	Good practice statement * Good practice statement Good practice statement *
Skin assessment and care	• Skin inspection should pay particular attention to the skin folds for signs of maceration. Areas of high adipose concentration such as the buttocks and weight of the pannus can also precipitate pressure injuries. pressure injuries need to be differentiated from intertriginous dermatitis. • Skin inspection should also include areas underneath medical devices and prophylactic dressings and continue at least daily. • Implement a skincare regime that includes keeping the skin clean and hydrated. Avoid alkaline soaps and cleansers, and use a barrier product to protect the skin from moisture. • Cleanse the skin promptly after incontinence episodes.	* A B2 B2 B2
Protective dressings	• Use soft silicone multi-layered foam dressings to protect the skin in individuals at risk of pressure injuries. • Be aware that medical devices can become entrapped in skin folds • A prophylactic dressing can be used beneath a medical device.	B1 Good practice statement B1
Nutrition	• High BMI individuals may be poorly nourished. • Complete a nutritional screening tool on admission. • Energy intake should be adjusted to the patients' conditions, weight change or level of obesity. For patients with obesity who are critically ill, refer to the American Society for Parental and Enteral Nutrition (ASPEN). Indirect calorimetry can be used to estimate energy needs, if unavailable, use a weight-based calculation: BMI > 30 to 50: 11–14 kcalories/kg actual body weight/day or for BMI > 50: 22–25 kcalories/kg ideal body weight/day. Protein recommendations as per the ASPEN guidelines for critically ill high BMI patients include; BMI > 30 to 40: 2.0 g/kg ideal body weight/day or BMI > 40: 2.5 g/kg ideal body weight/day.	* C C
Equipment	• Appropriate equipment with weight specifications needs to be available. • Use manual handling techniques and equipment that reduces shear and friction as this is often increased in high BMI patients. • Organizations should have manual handling strategies in place for the high BMI population to ensure patient and staff safety. • Diagnostic equipment such as magnetic resource imaging often does not accommodate high BMI patients. Measure the patients' physical dimensions prior to imaging procedures • Patients with a BMI > 45 should be placed on a wider bed regardless of mobility. Immobile patients with a BMI > 40 should be placed on a 127 cm wide bed. Patients with a BMI > 35 who are unable to reposition themselves laterally should be considered for a bed wider than 91 cm.	* B2 * * C
Support surfaces	• Select a support surface with enhanced pressure redistribution, shear reduction and microclimate features, as high BMI individuals are at increased risk of moisture and heat-trapping between the body and support surface. • Monitor the support surface for 'bottoming out'. • Ensure the bed surface area is sufficiently wide to allow turning of the patient. • Chair cushions and covers that permit air exchange to minimize temperature and moisture at the buttock interface are recommended. Use a bariatric pressure redistribution cushion on seated surfaces. • Incontinence pads should be compatible with the support surface and layers of linen minimized or removed to ensure optimal microclimate for the skin.	Good practice statement Good practice statement C C *
Repositioning	• Regularly reposition patients who are unable to reposition independently. If persistent erythema is present, repositioning frequency needs to be increased. • Use equipment and manual handling techniques that reduce friction and shear. • Consider using continuous bedside pressure mapping as a visual cue to guide repositioning. • A 90° side-lying position can increase pressure, therefore, a 30° side-lying position should be encouraged. This recommendation does not differentiate between patients' BMI.	B1 B2 C C

(Continues)

TABLE 3 (Continued)

Topic	Recommendation	Strength of evidence
Mobilization	• Promote early mobilization.	C
Interdisciplinary approach	• A team of healthcare professionals should be utilized including a dietician, physiotherapist, physician, occupational therapist and social worker where appropriate.	B1, B2
Patient education	• Educate the patient and their family and/or carer on prevention and management of pressure injuries and implement reminder strategies.	C
Health professional education	• Health professionals' knowledge should be assessed to facilitate education regarding skin examination skills, using equipment, pressure injury classification and staging and pressure injury preventative strategies.	B1
Strength of evidence rating for each recommendation (adapted from the EPUAP, NPIAP and PPPIA Clinical Practice Guidelines 2019)		
A	More than one high-quality Level I study providing direct evidence Consistent body of evidence	
B1	Level 1 studies of moderate or low quality providing direct evidence Level 2 studies of high or moderate quality providing direct evidence Most studies have consistent outcomes and inconsistencies can be explained	
B2	Level 2 studies of low quality providing direct evidence Levels 3 or 4 studies (regardless of quality) providing direct evidence Most studies have consistent outcomes and inconsistencies can be explained	
C	Level 5 studies (indirect evidence), for example, studies in normal human subjects, humans with other types of chronic wounds, animal models A body of evidence with inconsistencies that cannot be explained, reflecting genuine uncertainty surrounding the topic	
Good practice statement	Statements by the GGG that are not supported by a body of evidence as listed above but considered significant for clinical practice.	

Note: An asterisk (*) is placed where an evidence grade was not reported.

injury, finding 15 out of 483 patients had acquired one, with eight having a BMI ≥ 30. These authors emphasized the vigilance of nurses when undertaking skin assessments in high BMI patients (Coyer et al., 2014). High BMI is common in COVID-19 patients (Buffon et al., 2022; Capasso et al., 2022). Capasso et al. (2022) provide recommendations for pressure injury prevention in prone-positioned patients, including limiting prone positioning to <32 h, placing the endotracheal tube in the centre of the mouth with a prophylactic dressing under the bar of the tube holder, and providing frequent micro-shifting including lateral head turns every 2 to 4 h. Pressure redistribution products, such as gel pads, heel protector boots inverted over the anterior ankles, and silicon-coated foam dressings should be placed under body parts that protrude (Capasso et al., 2022).

Support surfaces. Grap et al.'s (2019) study found high BMI patients had a decreased risk for sacral pressure injury during a longer operation theatre time. The authors attributed this to the use of prophylactic support surfaces during longer operation theatre cases (Grap et al., 2019). Capasso et al. (2022) recommend using a powered bariatric pressure redistribution support surface for high BMI patients.

Interventional studies for hospital-acquired pressure injury prevention in high BMI patients. Repositioning. Ghezeljeh et al.'s (2017) RCT of 120 patients in ICUs in three hospitals compared the effect of bed elevation to 30°, 45° and routine bed positioning. The study was looking at ventilator-associated pneumonia, with pressure injury as a secondary outcome measure. All groups received 2 hourly liftings rather than shearing the patient on the bed. No group suffered pressure injury, concluding that bed head elevation was not associated with hospital-acquired pressure injury (Ghezeljeh et al., 2017).

A cohort study compared turning mechanically ventilated patients with a mean BMI of 30.97 using pillows/standard care, with a patient positioning system involving integrated handles, microclimate body pads and two foam wedges (Powers, 2016). Results showed that 1.48 staff took 2.38 min when repositioning using the patient positioning device, while standard care involved 2.26 staff taking 5.89 min. The turn angle on average was higher for the patient positioning system group compared to the standard care group. Within 24 h, the patient positioning system group sustained one pressure injury and the standard care group – six (Powers, 2016).

Rose et al. (2022) conducted a pretest-posttest using sensor monitors placed on patients to visually cue nursing staff to patients' repositioning needs, and provide automatic documentation of repositioning events. High BMI patients documented mean repositioning intervals improved to 2.5 h from 9.4 h. The authors discussed that visual cues were useful for high BMI patients as multiple staff members were alerted when repositioning was needed and these patients require a team approach to repositioning to prevent pressure injury (Rose et al., 2022).

Mobilization. A quasi-experimental study on mechanically ventilated ICU patients with a BMI ≥ 30 compared 50 patients receiving standard care, with 50 patients using six steps of mobilization (Atrous et al., 2021). On day 1, head of bed elevated 45 degrees; on day 2—45° and legs in dependent position; on day 3—60° with legs in dependent position; on day 4—dangling position; on day 5—chair sitting position, and on

TABLE 4 Research Question 3: Association between high BMI and occurrence of hospital-acquired pressure injury.

Author (year)	BMI range assessed	Variable(s)	Pressure injury risk		Interpretation of findings	Funding
			OR (95% CI)	*p*-value		
Amini et al. (2022)	BMI ≥ 30	BMI and Braden scale score < 14	0.58 (0.20 to 1.71)	.012	• Pressure injury incidence decreased with a BMI ≥ 30 • There was no relationship between BMI and pressure injury occurrence	University internal grant
Buffon et al. (2022)	BMI ≥ 30	Independent	N/R	1.0	• There was no relationship between BMI ≥ 30 and pressure injury occurrence	University internal grant
Capasso et al. (2022)	BMI 30–34.9 BMI 35–35.9 BMI ≥ 40	Independent	N/R	.337 .762 .020	• BMI ≥ 40 was a statistically significant risk factor for pressure injury development	No external sources of funding
Carson et al. (2018)	BMI ≥ 40	Independent	Operative group 4.61 (1.72 to 12.4) Adj.	.002	• Patients with a BMI ≥ 40 with pelvic and acetabular fractures treated operatively had a higher incidence of pressure injury than those with a BMI <40	No external sources of funding
Coyer et al. (2014)	BMI ≥ 30	Independent	N/R	N/R	• 8 out of 15 patients with MDR pressure injury had a BMI ≥ 30 • Nearly half of the MDR pressure injuries were mucous ulcers rather than skin ulcers. • Braden score was not related to MDR pressure injury occurrence	Foundation funding
Drake et al. (2010)	BMI ≥ 40	Independent BMI and Braden scale score	2.77 (1.28 to 5.99) Adj. N/R	.01 .04	• Patients with a BMI ≥ 40 had a higher incidence of pressure injury compared to patients with a BMI <40 • Braden score of 16 or less is a predictor of pressure injury occurrence in high BMI patients	N/R
Ditillo et al. (2014)	BMI ≥ 40	Independent	2.1 (1.6 to 2.9)	.01	• Patients with a BMI ≥ 40 had a higher incidence of pressure injury compared to 'non-obese' patients	N/R
Gardiner et al. (2014)	BMI > 30	Independent	0.62 (0.58 to 0.67) Adj.	<.0001	• No difference in pressure injury risk was found relating to BMI	National research scheme
Grap et al. (2019)	BMI ≥ 30	Independent High BMI, low Braden scale score and OR time	1.091 (0.989 to 1.203) 1.152 (1.024 to 1.297)	.14 .05	• BMI as an independent variable was not associated with pressure injury risk • As a multivariable, high BMI, low Braden score and OR time are associated with increased pressure injury risk • This may be explained by more care being taken to use positioning aids such as foam or gel pads for longer surgeries	National research scheme
Großschädl and Bauer (2022)	BMI > 30	Independent BMI and Braden scale score	0.657 (0.281 to 1.534) 0.544 (0.301 to 0.981)	.331 .043	• Risk of pressure injury measured along with the Braden scale was reduced for obese patients by 0.544 • Patients with a BMI <30 had a higher pressure injury risk than those with a BMI ≥ 30	N/R

(Continues)

TABLE 4 (Continued)

Author (year)	BMI range assessed	Variable(s)	Pressure injury risk		Interpretation of findings	Funding
			OR (95% CI)	*p*-value		
Hobson et al. (2017)	BMI > 30	Independent	N/R	.36	• 2.2% of patients developed GCS-associated pressure injuries • 31% of all pressure injuries and 74% of all MDR pressure injuries were related to static GCSs	National research scheme
Hyun et al. (2014)	BMI ≥ 40	Braden scale score	2.02 (1.21 to 3.38)	.008	• Patients with a BMI ≥ 40 and those with a BMI <19 are at increased risk of pressure injury compared to normal-weight patients • Patients with a BMI >40 were 3.7 times more likely to have a pressure injury compared to patients with a BMI of 25–40	National research scheme
Kayser et al. (2019)	BMI 40–45	Independent	1.02	<.001	• A U-shaped relationship was found for BMI, with low and high BMIs at greatest risk for pressure injury • A BMI of 40–45 reduced the risk of pressure injury	No external sources of funding
Kottner et al. (2011)	BMI ≥ 30	Independent	N/R	N/R	• There was no relationship between heel pressure injuries and BMI • A high BMI does not protect against pressure injuries at the truck nor increase the likelihood of them occurring • Patients with a BMI <18.5 are at increased risk of pressure injuries at the shoulder, hip, sacral and ischial areas compared to patients with a BMI of 18.5–24.9 and patients with a BMI ≥ 30	No external sources of funding
Litcherfeld-Kottner et al. (2020)	BMI ≥ 30	Gender	1.62 (1.20 to 2.20)	N/R	*Data extracted from hospitalized patients only • More women with hospital-acquired pressure injury were obese compared to men • More women at PU risk were underweight with a BMI <18.5	National research scheme
Mananzo et al. (2014)	BMI > 30	Independent	N/R	.12	• There was no statistically significant difference between the pressure injury and non-pressure injury group in relation to having a BMI > 30	N/R
Miller et al. (2016)	BMI > 30	Independent	N/R	.974	• There was no significant association between the hospital-acquired pressure injury and non-hospital-acquired pressure injury groups in regards to BMI	Industry funding, Industry funding, Foundation funding, University Internal grant
Ness et al. (2018)	BMI ≥ 30	Independent	1.118 (0.655 to 1.909)	.681	• BMI ≥ 40 is a risk factor for hospital-acquired pressure injury • Malnourished morbidly obese patients had 11 times the odds of hospital-acquired pressure injury development compared to well-nourished morbidly obese patients	No external sources of funding
	BMI ≥ 40	Independent	3.478 (1.657 to 7.303)	.001		
	BMI ≥ 40	BMI and malnutrition	11.143 (2.279 to 54.481)	.003		

TABLE 4 (Continued)

Author (year)	BMI range assessed	Variable(s)	Pressure injury risk		Interpretation of findings	Funding
			OR (95% CI)	*p*-value		
O'Brien et al. (2014)	BMI ≥ 30	Independent	0.87 (0.64 to 1.18)	.37	• A BMI of ≥30 was not associated with pressure injury development • A BMI <18.5 was associated with pressure injury development (*p*-value = .002)	University internal grant
Pokorny et al. (2014)	BMI ≥ 30 BMI ≥ 40	Braden scale score	N/R N/R	.16 .14	• No statistically significant differences in BMI subgroups for pressure injury prevalence were found	N/R
Qaddumi and Almahmoud (2019)	N/R 'Obese'	Independent	N/R	.57	• No relation was found between BMI category and pressure injury development • A significant relationship was found between pressure injury development and patients requiring mechanical ventilation (*p*-value = .001)	University internal grant
Raff et al. (2016)	BMI ≥ 30	Independent	1.27 (0.74 to 2.18)	N/R	• BMI and hypotension/shock on admission were not associated with pressure injury • Age, spinal cord injured patients and mechanical ventilation were found to be risk factors for pressure injury	N/R
Swanson et al. (2011)	BMI ≥ 30	Independent BMI and Braden scale score	N/R 4.51 (1.11 to 18.31)	.47 .59	• No significant difference was found between patients with a BMI ≥ 30 or ≤30 in regards to pressure injury prevalence or total Braden score • The Braden friction/shear subscale found a major difference in occurrence between patients with a BMI ≥ 30 (13.3%) and patients with a BMI ≤30 (5.3%)	N/R
Tracy et al. (2020)	BMI ≥ 30	Metabolic syndrome	N/R	.01	• The metabolic syndrome patients, who had a BMI range of 32.1 to 37.3, had significantly higher rates of pressure injury compared to those without metabolic syndrome and a BMI range of 22.6 to 29.8	N/R
VanGilder et al. (2010)	BMI ≥ 30–39.9 BMI ≥ 40	Independent	N/R	N/R	• Patients in the normal BMI range (18.5–24.9) had the highest percentage of total pressure injuries (34.7%) • BMI range 30–39.9 had 20.07% of pressure injuries and patients with a BMI ≥ 40 had 9.79% of pressure injuries	N/R
VanGilder et al. (2021)	BMI 30–40 BMI > 40	Independent	N/R	N/R	• Patients with a BMI <18.5 had the highest hospital-acquired pressure injury prevalence (5.54%) • Patients with a BMI of 30–40 and >40 had the lowest hospital-acquired pressure injury prevalence (2.40% and 2.38%)	N/R
Verekova et al. (2020)	N/R	Independent	N/R	>.05	• BMI was not a predictive factor in pressure injury development	N/R
Workum et al. (2022)	BMI ≥ 30	Independent	N/R	.907	• Patients with a BMI ≥ 30 were not at increased risk of pressure injury development compared to patients with a BMI 18–25	No external sources of funding

Abbreviations: Adj., adjusted; BMI, body mass index; GCS, graduated compression stocking; MDR, medical device related; N/R, not reported; OR, odds ratio; pressure injury, pressure injury.

day 6—walking with assistance. Results showed early mobilization had decreased pressure injury occurrence (Atrous et al., 2021).

Support surfaces. A quality improvement project for safe and effective patient steep Trendelenburg positioning during robot-assisted surgery compared patients with a BMI ≥ 30 using an air-inflating positioning device with high-density foam padding. Findings showed no difference in skin outcomes, but surgeons preferred foam padding and high BMI patients slipped in both groups (Sutton et al., 2013).

3.5.2 | Objective 2. Summarize nurses' experiences in preventing and/or managing hospital-acquired pressure injuries in people with a BMI of 30.0 or higher

Our review identified six themes relating to nurses' experiences when caring for high BMI patients, including inadequate staffing, lack of bariatric equipment, weight bias, staff fatigue, language issues, ethical dilemmas and the need for education.

Lack of bariatric equipment

A qualitative study of 20 nurses providing pressure injury prevention in acute care discussed the absence of a bariatric bed for an extremely obese patient resulting in an inability to roll the patient (Barakat-Johnson et al., 2019). High BMI can frequently exceed limits of computerized tomography and magnetic resource imaging machines (Tatusov et al., 2017), some of which only accommodate patients under 205 kilograms (Walker et al., 2019). Nurses discussed motorized equipment failing due to the patients' weight; including bed backrests (Hales et al., 2018). Equipment too small for high BMI patients, such as specialized chairs, blood pressure cuffs and scales, can create uncomfortable and unwelcoming environments. Some nurses reported lifters and walking frames being unavailable (Tanneberger & Ciupitu-Plath, 2018).

Inadequate staffing. Barakat-Johnson et al.'s (2019) study noted the lack of staff available to roll an obese patient but did not specify the nurse-to-patient ratios in these nursing units. Most respondents (78%) deemed nursing staff-to-patient ratios average to poor when caring for high BMI patients (Tanneberger & Ciupitu-Plath, 2018). The study did not specify the nurse-to-patient ratio in this Berlin Hospital but mentioned nurse-to-patient ratios in Germany are 1 nurse to 13 patients.

Weight bias. A survey with 73 nurses responding out of 100 revealed many negative stereotypes existed including high BMI patients being lazy, lacking willpower, being non-compliant and having poor personal hygiene; and believed these patients require more care than they are capable of providing (Tanneberger & Ciupitu-Plath, 2018). Some nurses advocated for equal care regardless of weight; and felt they had personally discriminated against obese patients (Tanneberger & Ciupitu-Plath, 2018).

Staff fatigue. Many nurses found caring for high BMI patients physically exhausting and time-consuming (Barakat-Johnson et al., 2019). Some felt their own strength and physical makeup reduced their ability to provide care to high BMI patients (Tanneberger & Ciupitu-Plath, 2018). Nurses reported the high volume of paperwork required to report a hospital-acquired pressure injury with duplicate documentation often found (Barakat-Johnson et al., 2019).

Ethical dilemmas in the care of high BMI patients. An ethics consultation was needed in a case study when the family of a 42-year-old woman with a pressure injury, who was on a diet plan, continued bringing in her food. Discussions included if the families' bags could be searched or relatives banned from bringing in food (Spike, 2018). Nurses have had difficulty locating discharge facilities appropriate for high BMI patients leading to longer hospital stays (Temple et al., 2017). Dambaugh and Ecklund (2016) discussed the refusal of a high BMI patient to mobilize, despite reassuring, believing the hospital recliner would not accommodate her weight. Interviews of 67 ICU nurses and 13 ICU doctors concluded terms 'obese', 'morbidly obese' and 'fat' were problematic. There was no determined appropriate language available to consider patients' feelings (Hales et al., 2018).

The need for health professionals' education. Walker et al. (2019) conducted online surveys and semi-structured focus group meetings of 38 physicians, 10 physician assistants and eight nurse practitioners; and identified inadequate pressure injury prevention and management knowledge, including related to differentiation diagnosis with moisture dermatitis, especially in high BMI patients (Walker et al., 2019). In another study, participants felt nurses need more education on diagnosing pressure injury in high BMI patients (Barakat-Johnson et al., 2019).

3.5.3 | Objective 3. Association between a BMI of 30.0 or higher and occurrence and severity of hospital-acquired pressure injury

Occurrence of hospital-acquired pressure injury in high BMI patients

Our review included 28 studies examining the relationship between hospital-acquired pressure injury occurrence in high BMI patients (Table 4) with six finding an association between hospital-acquired pressure injury and BMI ≥ 40 (Capasso et al., 2022; Carson et al., 2018; Ditillo et al., 2014; Drake et al., 2010; Hyun et al., 2014; Ness et al., 2018). Three further studies found significant associations, including Grap et al. (2019) in their multivariate model with BMI ≥ 30, low Braden (Braden & Bergstrom, 1987) score and OR time. Tracy et al. (2020) found patients with metabolic syndrome and a BMI range of 32.1 to 37.3 had higher pressure injury occurrence than those without metabolic syndrome and a BMI of 22.6 to 29.8. Kayser et al. (2019) found a U-shaped relationship with low and

high BMIs at the greatest risk for pressure injury, with a BMI of 40 to 45 providing reduced risk.

Nineteen studies totalling over 1 million patients found no association between BMI ≥ 30 and pressure injury occurrence (Amini et al., 2022; Buffon et al., 2022; Capasso et al., 2022; Gardiner et al., 2014; Großschädl & Bauer, 2022; Hobson et al., 2017; Kottner et al., 2011; Litcherfeld-Kottner et al., 2020; Mananzo et al., 2014; Miller et al., 2016; O'Brien et al., 2014; Pokorny et al., 2014; Qaddumi & Almahmoud, 2019; Raff et al., 2016; Swanson et al., 2011; VanGilder et al., 2010, 2021; Verekova et al., 2020; Workum et al., 2022). Lastly, Coyer et al. (2014) found 8 out of 15 patients who developed a medical device-related pressure injury had a BMI ≥ 30, with nearly half being mucous ulcers, no skin ulcers, but with no *p*-value or odds ratio reported for this finding.

Severity of hospital-acquired pressure injury developed in high BMI patients. Six studies were found discussing severity of pressure injury in relation to BMI (Kayser et al., 2019; Kottner et al., 2011; Ness et al., 2018; VanGilder et al., 2010, 2021; Workum et al., 2022). Kayser et al.'s (2019) retrospective analysis of the 2011–2016 International Pressure Ulcer Prevalence data, found a U-shaped relationship with BMI and superficial or severe pressure injury. A BMI of 40 and 45 reduced the possibility of superficial (categorized as stage one or two) pressure injury (Kayser et al., 2019). A BMI of ≥40.0 in VanGilder et al.'s (2010) study was associated with decreasing numbers of suspected deep tissue injury, with the suggestion that bony prominences may be protected by thicker layers of skin. VanGilder et al. (2021) found stage four pressure injuries were most common in patients with a BMI of 30–40 and stage two pressure injuries were common in all BMI groups.

Kottner et al. (2011) hypothesized that BMI is related to deep category three and four pressure injury at the trunk due to the 'inside-out' theory. However, their data included increased pressure injury in thin individuals and possible damage to the dermis and epidermis in thin individuals due to moisture or other factors. They suggested this may occur for morbidly obese dependent patients but the study design did not allow these factors to be distinguishable (Kottner et al., 2011). Ness et al. (2018) discuss pressure injury severity in 13 patients with a BMI ≥ 40. Five patients developed stage two pressure injury and three patients developed stage one pressure injury. However, this was subject to type II error due to a small sample size (Ness et al., 2018). Workum et al. (2022) found no difference in pressure injury severity between patients with a BMI ≥ 30 compared to those with a BMI of 18–25 (Workum et al., 2022).

4 | DISCUSSION

4.1 | Summary of evidence

This is the first scoping review that comprehensively discusses qualitative and quantitative sources relating the hospital-acquired pressure injury prevention and care in high BMI patients with the focus on hospital-acquired pressure injury. We have summarized best practices for hospital-acquired pressure injury in high BMI patients based off of the *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline 2019* and included four eligible interventional studies relating to mobilization, repositioning and support surfaces. The findings of this review focused on addressing the following three objectives: (1) exploring best practices for hospital-acquired pressure injury prevention in high BMI patients; (2) summarizing nurses' experiences in preventing and/or managing hospital-acquired pressure injury in high BMI patients; and (3) investigating the association between high BMI and occurrence and severity of hospital-acquired pressure injury.

The findings, in line with the previous study (Jacq et al., 2021), indicate preventative pressure injury strategies for high BMI patients involve a multifactorial approach incorporating risk assessment, skin assessment and care, protective dressings, nutrition, equipment, support surfaces, repositioning, mobilization, interdisciplinary approach, patient education and health professional education. However, findings are based on low-quality evidence. Thematic analysis identified nurses' experiences including lack of bariatric equipment, inadequate staffing, weight bias, fatigue, obesity-related terminology issues, the need for education and ethical dilemmas with hospital-acquired pressure injury prevention in high BMI patients. Contrasting results relating to occurrence and severity in high BMI patients were found, the majority of studies found no association with hospital-acquired pressure injury occurrence in high BMI patients with limited literature available assessing the severity of hospital-acquired pressure injury developed in high BMI patients provided inconclusive results.

4.2 | Best practices for hospital-acquired pressure injury prevention in high BMI patients

4.2.1 | Risk assessment

All included studies that used a risk assessment tool in their analysis, used the Braden scale (Coyer et al., 2014; Drake et al., 2010; Ghezeljeh et al., 2017; Grap et al., 2019; Großschädl & Bauer, 2022; Hyun et al., 2014; Miller et al., 2016; Pokorny et al., 2014; Powers, 2016; Swanson et al., 2011). The clinical practice guidelines mention high BMI individuals are inclined to drag their sacrum and heels when getting out of bed, causing shear and friction (European Pressure Ulcer Advisory Panel et al., 2019). Our review findings suggest the friction and shear, and nutrition subscales of the Braden scale (Braden & Bergstrom, 1987) are important indicators for pressure injury risk in high BMI patients.

4.2.2 | Nutrition

Nutrition plays an important role in pressure injury prevention and management (Munoz et al., 2020; Jacq et al., 2021). Included

studies have acknowledged high BMI patients may be malnourished (Dambaugh & Ecklund, 2016; Ness et al., 2018) and that this is associated with pressure injury occurrence (Ness et al., 2018; Pokorny et al., 2014). The International guidelines discuss the American Society for Parental and Enteral Nutrition (ASPEN) 2016 and 2017 energy and protein recommendations for critically ill obese patients (European Pressure Ulcer Advisory Panel et al., 2019). Our review findings suggest (along with current clinical practice guidelines) high BMI patients are at risk of malnutrition and a screening tool should be utilized to identify this, to then enable dieticians' input.

4.2.3 | Skin assessment and care

No studies focusing solely on skin assessment in high BMI patients were found, however, Coyer et al. (2014) emphasize mucous membrane assessment during skin assessment, particularly in patients with medical devices. Best practice guidelines highlight inspection of skin folds and areas of high adipose tissue, such as the pannus, buttocks and underneath medical devices and prophylactic dressings, while using non-soap and non-alcohol-based cleansers to cleanse the skin, then using a barrier product to protect against moisture (European Pressure Ulcer Advisory Panel et al., 2019). Proned patients should have pressure redistribution products placed over anterior body parts that protrude such as gel pads and prophylactic dressings, lateral head turns every 2 to 4 h and prone time limited to less than 32 h (Capasso et al., 2022).

4.2.4 | Protective dressings

Our review did not find any studies assessing the effectiveness of different dressing types in the high BMI population. The International clinical practice guidelines (2019) recommend prophylactic soft silicone foam dressings for pressure injury prevention in high BMI patients (European Pressure Ulcer Advisory Panel et al., 2019).

4.2.5 | Repositioning

Ghezeljeh et al.'s (2017) RCT showed the importance of using a lifter for high BMI patients rather than shearing to prevent pressure injuries. This study's effectiveness has been impacted by its low sample size, single-centre study and short duration of intervention. Powers et al.'s (2016) study showed using a patient positioning system including foam wedges, microclimate body pads and integrated handles, enhanced staff efficiency while reducing pressure injury occurrence, compared to using standard pillows. The findings suggest standard pillows are ineffective in maintaining position; however, different pillows within the institution were used when turning (Powers, 2016). The effectiveness of this intervention for high BMI patients does come into question as not all institutions use the same type and number of pillows for each turn; it was a small sample size and lack of randomization.

An ideal turning and repositioning schedule for dependent morbidly obese patients needs further research for pressure injury prevention, however, it should be recognized that Ghezeljeh et al.'s (2017) study participants were repositioned 2 hourly and no pressure injury developed. The International clinical practice guidelines (2019) also recognize there are limited clinical trials examining the effect and frequency of repositioning. Repositioning frequency should consider the patients' level of activity and ability to reposition independently (European Pressure Ulcer Advisory Panel et al., 2019).

4.2.6 | Early mobilization

Atrous et al. (2021) was the only study we found exploring early mobilization in high BMI patients and their results highlighted the benefits of this approach, with the intervention group, who mobilized using six steps, having a statistically significant lower incidence of pressure injuries, compared to the group receiving standard care (Atrous et al., 2021). However, the small sample size, lack of randomization and single-centre study impact the generalisability of results.

4.2.7 | Equipment

Our review did not include any studies evaluating the effectiveness of equipment in high BMI patients with regard to pressure injury prevention. Several studies stressed the importance of appropriately sized equipment for patient comfort and pressure injury prevention (Großschädl & Bauer, 2022; Kayser et al., 2019). Wiggerman et al. (2017) recommend that patients with a BMI > 35 and unable to laterally reposition themselves, be considered for a bed wider than 91 cm. Patients with a BMI > 45 should have a wider bed regardless of mobility and dependent patients should have a 127 cm wide bed (European Pressure Ulcer Advisory Panel et al., 2019). Our review indicates the importance of weight and height measurement of high BMI patients on admission to ensure appropriate equipment including chairs, commodes and hoists are accessible.

4.2.8 | Support surfaces

Grap et al. (2019) reviewed the lack of support surfaces in the operation theatre, finding high BMI patients undergoing short operations should be considered for protective support surfaces such as foam and gel pads. Sutton et al. (2013) compared an air inflating device to high-density foam padding during robotic surgery, finding neither more beneficial as high BMI patients slipped on both surfaces (Sutton et al., 2013). The effectiveness of this interventional study is limited due to the small sample size and high level of bias as findings were specific to the institution and surgeon preference. Our review

highlights the importance of continual nurse assessment of patients' positions during surgery to prevent friction and shearing.

Capasso et al. (2022) encourage the use of powered bariatric pressure redistribution support surface to prevent pressure injury to the sacrococcygeal region, with fewer patients developing pressure injuries who were on a powered support surface compared to nonpowered (Capasso et al., 2022). This study's validity is impacted due to the small sample size and limited numbers of staff entering the COVID-19 patients' rooms (Capasso et al., 2022). McInnes et al.'s (2018) systematic review, *Support surfaces for treating pressure ulcers*, was also unable to conclude which support surface is best for treating pressure injuries, or for preventing hospital-acquired pressure injury in high BMI patients, due to low-quality evidence (McInnes et al., 2018).

The *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline 2019* recommend support surfaces that optimize pressure redistribution and microclimate control be utilized for high BMI patients (European Pressure Ulcer Advisory Panel et al., 2019). Furthermore, a pillow or foam cushion elevates heels and distributes pressure over the lower legs, while two to three layers of linen can accelerate skin breakdown (European Pressure Ulcer Advisory Panel et al., 2019).

4.2.9 | Interdisciplinary approach

High BMI patients usually have other challenging health conditions (Tanneberger & Ciupitu-Plath, 2018). An interdisciplinary approach to patient care is important (Temple et al., 2017) and should incorporate a dietician, physiotherapist, physician, occupational therapist and social worker where appropriate. A care plan detailing each body system provides interprofessional collaboration to provide optimal care and outcomes for high BMI patients (Dambaugh & Ecklund, 2016).

4.3 | Nurses' experiences in preventing and/or managing hospital-acquired pressure injury in high BMI patients

Valuable, detailed descriptions of nurses' experiences including direct quotes from acute care nurses were provided from multiple studies (Barakat-Johnson et al., 2019; Hales et al., 2018; Tanneberger & Ciupitu-Plath, 2018; Walker et al., 2019).

Lack of resources to adequately care for high BMI patients causes distress to nurses. Organizational implementation of adequate resources, staffing, education and guidelines are needed to enhance patient safety and quality of care provided. The need for additional staff to care for high BMI patients was also found to lead to weight bias and some nurses believed high BMI patients receive poorer care (Tanneberger & Ciupitu-Plath, 2018). Our results indicate the need for the development of nursing educational interventions addressing weight bias and discrimination, manual handling techniques and correct use of bariatric equipment. Discussion is needed to select appropriate language to describe high BMI patients as many nurses felt awkward and concerned when describing the physical size of high BMI patients. Our review was not researching the patients' experiences, therefore, conducting interviews with high BMI patients could provide a more holistic understanding.

Barakat-Johnson et al. (2019) used purposive sampling and all their participants were female, therefore excluding male nurses' views. The first author was known to some of the participants which may have impacted on the responses given. The majority of Tanneberger and Ciupitu-Plath's (2018) participants had daily contact with high BMI patients which may have influenced weight bias towards them. Hales et al. (2018) used focused observation, which may have altered and sensitized the nurses' behaviour. Huang et al. (2021) reviewed articles relating to nursing workload in obese patients and identified similar issues we identified in our review including lack of appropriate equipment and inadequate staffing. Lack of organizational policies and guidelines when caring for high BMI patients can lead to poor nursing practices and increased nursing workload was also discussed (Huang et al., 2021). Leen (2010), Berrios (2016) and Lloyd-Jones (2021) have published articles providing nursing care points for bariatric care and Smigelski-Theiss et al. (2017) have addressed weight bias in acute care but these publication types were ineligible for inclusion in our review.

4.4 | Association between high BMI and occurrence and severity of hospital-acquired pressure injury

The association between hospital-acquired pressure injury and high BMI patients has produced contrasting results, with the majority (18 out of 28) studies finding no significant association and six finding a significant association between BMI > 40 and hospital-acquired pressure injury. All studies assessing a BMI ≥ 30, as an independent variable, did not find any significant association with hospital-acquired pressure injury. The latest International clinical practice guidelines also recognize there are contrasting findings relating to high BMI and its association with pressure injuries, providing unclear results citing Cai et al. (2013), Compher et al. (2007), Kottner et al. (2011), Swanson et al. (2011) and VanGilder et al. (2010). Only two of these studies (Kottner et al., 2011; Swanson et al., 2011) were eligible for inclusion in our review. A systematic review and meta-analysis of 17 studies reviewing the incidence and prevalence of pressure injuries in relation to body weight, concluded obesity or morbid obesity had no significant effect on the pressure injury development. They found underweight patients were at significantly increased pressure injury risk (Alipoor et al., 2021). This study differs from ours as they included patients in nursing homes and undertook a meta-analysis.

Severity of hospital-acquired pressure injury in high BMI patients was difficult to attain due to non-comparable pressure injury stages and limited literature available. The four studies discussing pressure injury severity in high BMI patients found different results. Non-comparable pressure injury stages were also an issue in the clinical practice guidelines when researching the relationship between high BMI and pressure injuries (European Pressure Ulcer Advisory Panel et al., 2019).

5 | LIMITATIONS

This review has several limitations. Some relevant articles may have been missed as we only included studies published in English. This review involved three specific objectives with broad inclusion criteria, creating difficulty categorizing the most appropriate studies for each objective. Appraisal was conducted by one author, and if unsure, a second author was contacted. There is a large inconsistency among included studies with the BMI range used to assess the impact of obesity. Therefore, studies not specifically using a BMI range of ≥30.0 have been excluded, such as Lovegrove et al. (2018) who report obesity as a BMI range > 25. Other studies have been included but do not mention a specific BMI range when discussing obesity (Ditillo et al., 2014), making the generalization of results difficult. Hyun et al.'s (2014) study included patients with a BMI range from 25 to 40, however, we only included the patients with a BMI ≥ 40 in our review findings. How BMI data were obtained in each study was not reviewed; patients' self-reporting weight may cause inaccurate BMI classifications. Three of the five interventional studies were undertaken in the ICU setting with the fourth undertaken in the operation theatre. Not all studies reported the acute care area involved or where participants worked.

Limited literature was available on the severity of pressure injuries in high BMI patients, those which included severity measured them in different ways. Some only focussed on suspected deep tissue injury (VanGilder et al., 2010), while another did not assess severity in relation to weight (Coyer et al., 2014). Finally, coronavirus (COVID-19) pandemic brought new nuances and perspectives to pressure injury prevention and management related to prone positioning (Team et al., 2020) and related nurses' experiences, which were not reflected in this review. Nonetheless, we believe we covered a wide range of relevant studies relating to hospital-acquired pressure injury prevention in high BMI patients.

6 | ADDITIONAL EXPLANATION

We did not separate inclusion and exclusion criteria for all three objectives as we conducted a broad search to see what research was available. We selected the appropriate type of study design for each objective. We recognized that identifying best practices for hospital-acquired pressure injury prevention required results from interventional studies. Therefore, case studies, observational and evaluation studies were excluded to address Objective 1, and interventional studies were only included in Objective 1, if they included a comparison group. We excluded surveys with closed-ended questions from Objective 2 as they lacked a descriptive account of nurses' experiences.

7 | IMPLICATIONS FOR RESEARCH

Objective 1 identified the compelling need for high quality, large sample size, multicentre trials to evaluate pressure injury prevention practices in high BMI patients. Additional clinical trials are needed examining turning and repositioning frequency for dependent high BMI patients, particularly support surfaces inward and operation theatre settings and effectiveness of pressure redistribution surfaces in high BMI patients. Furthermore, types of prophylactic dressings, pressure injury risk and nutritional risk assessment tools appropriate for high BMI patients need researching. More high-quality interventional studies are needed in ward settings besides ICU or operation theatre. Objective 2 recognized the need for acceptable and appropriate obesity-related terminology. As shown in Objective 3, the BMI range for obesity has been inconsistent, highlighting the need for future research to maintain consistency when classifying the BMI range for obesity, which can be done by utilizing the World Health Organization classification (World Health Organization, 2021). Further research is needed into the severity of pressure injuries in high BMI patients.

8 | IMPLICATIONS FOR CLINICAL PRACTICE

Nurses need readily available bariatric equipment and appropriate staffing levels to provide optimal care. Systematic risk assessment is vital in evaluating the potential development of pressure injuries among high BMI patients. A checklist compromising a bundle of preventive actions should be implemented for high BMI patients who are at a heightened risk of developing pressure injuries. Continuing education in pressure injury prevention can positively impact nurses' practice and attitudes, and this education should also focus on weight bias. Skin assessment should include mucous membrane assessment, particularly when medical devices are in use. Nutritional and skin assessment, early mobilization, regular repositioning, support surfaces with shear reduction and microclimate features, and an interdisciplinary approach should be continuing for high BMI patients. Organizations should consider implementing bariatric care and patient positioning systems to benefit both patients and nurses with pressure injury prevention. The validated and standardized care load to predict nursing ratios tailored to individual patients could also be considered in the future clinical practice. Especially in situations where the nurse-to-patient ratio might be comparatively low, the option of supplementing nursing resources on a temporary basis for specific patient needs could be explored. Establishing a specialized team, such as a bariatric/lift team (McClean et al., 2021), might

prove instrumental in addressing the unique requirements of high BMI patients with higher care demands, thereby reducing the risk of pressure injury development.

9 | CONCLUSIONS

The findings of this scoping review indicate a multifactorial approach is needed to prevent pressure injuries in high BMI patients. However, the findings are based on low-quality evidence and larger clinical trials of high BMI patients are needed in the areas of turning and repositioning frequency, support surfaces, prophylactic dressings and risk assessment tools. Thematic analysis identified nurses need educational interventions addressing weight bias and pressure injury prevention. Organizations need guidelines addressing pressure injury prevention to ensure appropriate resources and staffing levels are available for nurses caring for high BMI patients. There were contrasting results regarding occurrence and severity in high BMI patients with most studies finding no association with hospital-acquired pressure injury in these patients. The limited literature available assessing the severity of hospital-acquired pressure injury developed in high BMI patients provided inconclusive results and requires further research.

AUTHOR CONTRIBUTIONS

Victoria Marshall: validation, investigation, formal analysis, data curation, writing—original draft and writing—review and editing; Yunjing Qiu: validation, formal analysis, data curation and writing—review and editing; Angela Jones: conceptualization, methodology, validation, investigation, formal analysis, data curation and writing—review and editing; Carolina Dragica Weller: conceptualization, methodology, writing—review and editing and supervision; Victoria Team: conceptualization, methodology, validation, investigation, formal analysis, data curation, writing—review and editing and supervision.

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CONFLICT OF INTEREST STATEMENT

None to declare.

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DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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